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FIELD SAMPLING PLAN

UPPER ANIMAS MINING DISTRICT
San Juan County, Colorado

TDD No. 1008-13

OCTOBER 21, 2010

URS
OPERATING SERVICES, INC.

In association with:
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CERCLIS ID# CO0001411347

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Silverton, San Juan County, Colorado

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1.0 INTRODUCTION

URS Operating Services, Inc. (UOS) has been tasked by the U.S. Environmental Protection Agency (EPA), Region 8, to conduct a Site Reassessment (SR) of the Cement Creek drainage of the Upper Animas Mining District site in Silverton and San Juan County, Colorado. Field work for this SR is projected to be completed during October and November 2010.

This Field Sampling Plan (FSP) is designed to guide field operations during the SR, and has been prepared in accordance with Technical Direction Document (TDD) #1008-13, the EPA "Guidance for Performing Site Inspections Under CERCLA," Interim Final, September 1992, the "Region 8 Supplement to Guidance for Performing Site Inspections Under CERCLA," and the "UOS Generic Quality Assurance Project Plan" (QAPP) (EPA 1992, 1993; UOS 2008). The SR field work will include sampling and non-sampling data collection. Soil, surface water, and sediment samples will be collected. Sampling procedures will adhere strictly to those outlined in the UOS Technical Standard Operating Procedures (TSOPs) for field operations at hazardous waste sites (UOS 2005).

Site characterization will potentially include 66 surface water samples, 58 sediment samples, and 33 soil samples (all of which will be source samples). Also, three surface water samples, three sediment samples and three soil samples will be collected for field Quality Assurance/Quality Control (QA/QC) samples (in addition to extra volume for the laboratory matrix spike/matrix spike duplicates [MS/MSDs]) (Table 1). The QA/QC samples will follow the requirements of the "Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA" (EPA 1992).

All samples will be analyzed through the EPA Region 8 Environmental Services Assistance Team (ESAT) for metals. In addition, selected source and sediment samples will be submitted for pesticides/polychlorinated biphenyls (Pest/PCBs) analyses by the EPA Contract Laboratory Program (CLP).

2.0 OBJECTIVES

The purpose of this focused SR is to gather information for the evaluation of this site with regard to the EPA's Hazard Ranking System (HRS) criteria (Office of the Federal Register [OFR] 1990). The specific objectives of this focused SR are:

- Document and evaluate source areas; including waste volumes;
- Document overland flow of water to Cement Creek;

- Evaluate targets for the groundwater, surface water, soil, and air pathways;
- Evaluate non-sampling data documenting past observed releases from site source areas;
- Collect surface water samples to document a release to Cement Creek and the Animas River;
- Collect sediment samples to document a release to Cement Creek and the Animas River;
- Document target locations for fisheries and wetlands;
- Document fisheries use; and
- Collect soil samples to characterize potential contaminants at the site and characterize the extent of surface soil contamination that may affect the nearby residents, Silverton Mountain workers, all-terrain vehicle (ATV) riders and other recreationalists.

3.0 BACKGROUND INFORMATION

3.1 SITE LOCATION AND DESCRIPTION

Cement Creek originates high in the rugged San Juan Mountains of southwestern Colorado near the San Juan County and Ouray County line on the south slopes of Red Mountain Number 3 and the north slopes of Storm Peak. Cement Creek begins at an elevation of 13,000 feet above mean sea level (MSL) and flows seven miles southward to an elevation of 9,305 feet above MSL at its confluence with the Animas River at Silverton, Colorado (Figures 1, 2, and 3) (Colorado Department of Public Health and Environment [CDPHE] 1998). The name Cement Creek probably refers to the iron rich precipitates (ferricrete) that coat and cement the stream bed materials (Photos 1 and 2) (U. S. Geological Survey [USGS] 2007e). This investigation will focus on the largest sources of unremediated mine waste in Upper Cement Creek (above Gladstone) including Gold King 7 Level Mine, Red and Bonita Mine, Mogul Mine, Mogul North Mine (also known as the Mogul Sublevel 1), Grand Mogul Mine, Queen Anne Mine, and potentially Columbia Mine and Adelphin Mine. These mines will henceforth be referred to as the "upper Cement Creek mines." This investigation will also address potential PCB contamination in the aforementioned sources and sediments of Cement Creek and the Animas River.

3.2 SITE HISTORY AND PREVIOUS WORK

3.2.1 Mining Activities

The rugged and relatively inaccessible western San Juan Mountains were first prospected by the Baker party, which explored the area around Silverton in 1860. After a treaty with the Ute Indians was revised, mining began in 1874, and George Green brought the first smelter equipment into the area at Baker's Park that year (Silverton Magazine 2009). The extension of the railroad from Silverton up Cement Creek to Gladstone in 1899 encouraged the mining of low grade ores, and the establishment of a lead-zinc flotation plant in 1917 allowed for the treatment of the low grade complex ores found in the area (USGS 1969). The last producing mine in the area was the Sunnyside Mine, which ceased production in 1991 (USGS 2007c). The closing of the Sunnyside mine occurred after Lake Emma drained into the mine and out the American Tunnel into Cement Creek in 1978. The flood water from the Lake Emma "blow-out" was reported to have flowed down Cement Creek in a 10-foot wall of water that would have transported a large quantity of tailing and other mine waste down Cement Creek to the Animas River (The Silverton Railroads 2009).

Over a 100-year period between 1890 and 1991, mining activities in the Upper Animas River Basin, including Cement Creek, produced the waste rock and mill tailings sources from which contamination spread throughout the surface water pathway. Over 18 million tons of ore were mined from the Upper Animas River Basin area, with more than 95 percent of this being dumped directly into the Animas River and its tributaries in the form of mill waste. Older waste rock piles and stope fillings were reworked and sent to mills as technology allowed lower grade ores to be economically processed. A great deal of abandoned waste was also milled during World War II when many older mining and milling structures were cannibalized for scrap metal. The history of mining and milling in the Cement Creek area can be divided into four eras, each of which produced different types and volumes of mine wastes.

- Phase 1 The Smelting Era (1871-1889). Mines were usually small, mining was done by hand, milling was rarely done, and small amounts of often highly mineralized rock were left in surface dumps. Zinc minerals were preferentially removed from the ore and left in mine dumps because zinc created problems during the smelting process. Total production of the entire Upper Animas River area during this era is estimated to be 93,527 short tons. Very little mine or mill tailings were directly discharged into the area streams (USGS 2007c).

- Phase 2 The Gravity Milling Era (1890-1913). Federal Government support coupled with the introduction of higher capacity mining and milling techniques encouraged the mining of lower grade ores. Milling became the predominant ore processing method as ore values dropped and tonnage increased. Large volumes of mine and milling wastes were discharged directly into streams. Gravity mills recovered as much as 80 percent of the metals; however, zinc, iron pyrite, and some copper compounds were not recoverable, and when discharged into the streams, were easily spread downstream throughout the environment. Between 1890 and 1913 the total production of the entire Upper Animas River area was estimated at 4.3 million short tons (USGS 2007c). Approximately 95 percent of the waste generated during this era was discharged directly into the area streams (USGS 2007c).

- Phase 3 The Early Flotation Era (1914-1935). The increased demand for metals caused by World War I further accelerated the trend to larger scale mining and milling in the area. Ball mill grinding and froth flotation for concentrating ores were introduced, and again most mill tailings were dumped directly into area streams. During this era total production of the entire Upper Animas River area was estimated at 4.2 million short tons, of which only 36,232 short tons were shipped out of the area to be smelted (USGS 2007c).

- Phase 4 The Modern Flotation Era (1936-1991). Mining almost came to a halt during the Great Depression, but mining activity resumed during World War II when many mines and mills were reopened with substantial support from the Federal Government. In addition to the newly mined material, waste rock from abandoned mines, in both the waste dumps and the old underground stope fills, was reclaimed and processed. Mining and milling processes improved in detail, but still used familiar technology. The major change was the impoundment of mill tailings that began as a result of a 1935 Colorado Supreme Court ruling that required operations to contain mill tailings. Some early attempts to contain mill tailings were not completely successful and resulted in catastrophic releases of mill tailings to area streams. Mining and milling in the Upper Animas River area had substantially decreased by 1953, and all mining and milling activity ceased in 1991. During this era total production of the entire Upper Animas River area was estimated at 9.5 million short tons. All mill tailings were impounded in settling ponds except for an estimated 200,000 short tons of mill tailings that were released into the Animas River area streams. Ore shipments to smelters totaled only 8,148 tons out of the 9.5 million short tons of production during this final era (USGS 2007c).

Reclamation activities have been ongoing in the Cement Creek basin since 1991 when tailings were removed from the Lead Carbonate Mill site. Reclamation work has also been conducted in Gladstone at the American Tunnel waste dump and portal, Herbert Placer settling ponds, and the Gold King 7 Level Mine. Downstream of Gladstone on Prospect Gulch several mine sites have been remediated, including the Galena Queen, Hercules Mine, Henrietta Mine, and most recently at the Joe and John Mine and the Lark Mine in 2006 and 2007 (Animas River Stakeholders Group [ARSG] 2007). No new reclamation activities were initiated in 2008 or 2009 (ARSG 2009). In 2010, the EPA initiated a removal assessment at the Red & Bonita Mine. EPA and the Bureau of Land Management (BLM)/ USDA-Forest Service are also initiating the viability of removal assessments at the Grand Mogul Mine, which consists of both private and federally-managed parcels.

3.2.2 Summary of Previous Environmental Assessment Work

- March 1995 — *Reconnaissance Feasibility Investigation Report of the Upper Animas River Basin.* Colorado Division of Minerals and Geology. J. Herron, B. Stover, P. Krabacher, and D. Bucknam.

- October 1995 — *Animas Discovery Report – Upper Animas River Basin.* CDPHE – Hazardous Materials and Waste Management Division. Camille Farrell.

- February 1997 — *Water Quality and Sources of Metal Loading to the Upper Animas River Basin.* CDPHE – Water Quality Control Division. J. Robert Owen.

- July 1997 — *Sampling and Analysis Plan for a Site Inspection of the Upper Animas Watershed, Silverton Mining District, San Juan County, Colorado.* CDPHE – Hazardous Materials and Waste Management Division. Camille Farrell.

- April 1998 — *Analytical Results Report, Cement Creek Watershed, San Juan County, Colorado.* CDPHE Hazardous Materials and Waste Management Division. Camille Farrell. Five ground water, 6 surface water, 53 sediment, and 15 source samples collected in 1996. Data validation reports are not available. These data are not usable for a HRS evaluation of the site because sample locations are not documented and data validation cannot be documented.

- September 1998 — *Cement Creek Reclamation Feasibility Report, Upper Animas River Basin.* Colorado Division of Minerals and Geology. Jim Herron, Bruce Stover, and Paul Krabacher. Forty waste rock locations and four soil locations in the Cement Creek drainage were sampled by collecting a liquid extract of the rock or soil material from 10 to 20 aliquots at each location. These data are not usable for a HRS evaluation of the site because the analytical results are for extracts from composite samples.

- March 1999 — *Site Inspection Analytical Results Report for the Upper Animas Watershed, San Juan County, Colorado.* CDPHE – Hazardous Materials and Waste Management Division. Camille Farrell. Samples of mine waste rock, seeps, surface water, and sediment collected in 1997. Exact locations of samples were not documented. Photographs of sample locations are available. Data validation reports are not available. These data are not usable for an HRS evaluation of the site because sample locations are not documented and data validation cannot be documented.

3.3 SITE CHARACTERISTICS

3.3.1 Physical Geography

The Cement Creek drainage of the Upper Animas Mining District site is located north of the Town of Silverton, Colorado and is located on a combination of public and private property. The elevation of the Cement Creek drainage ranges from 9,305 to 13,000 feet above MSL (USGS 1955).

3.3.2 Geology

The Cement Creek basin is located in the volcanic terrain of the San Juan Mountains. The area was a late Oligocene volcanic center where the eruption of many cubic miles of lava and volcanic tuffs covered the area to a depth of more than a mile (USGS 1969). The formation of the 10-mile diameter Silverton caldera produced faults that are generally concentric circular features. The caldera collapse was followed by multiple episodes of hydrothermal activity that produced widespread alteration and mineralization of the rocks (USGS 2007a). Cement Creek flows through the middle of the old Silverton caldera (EPA 1999).

The predominant rock type found in the Cement Creek Basin is the Oligocene Age Silverton Volcanics. The Silverton Volcanics are lava flows of intermediate to silicic composition and related volcaniclastic sediments that accumulated to a thickness of approximately 1,000 feet around older volcanoes prior to the subsidence of the Silverton Caldera (USGS 2002).

The regional propylitization of the rocks in the area prior to the collapse of the calderas created an altered regional rock type that contains significant amounts of calcite ($CaCO_3$), epidote ($Ca_2Fe(Al_2O)(OH)(Si_2O_7)(SiO_4)$), and chlorite ($(MgFeAl)_6(SiAl)_4O_{10}(OH)_8$), all of which contribute to the intrinsic acid-neutralizing capacity of the major regional rock type. Three major areas of post-caldera collapse mineralization and alteration have been identified in the Cement Creek drainage. The Ohio Peak-Anvil Mountain (OPAM) area on the west side of the lower Cement Creek drainage and the Red Mountains area on the northwest side of the upper Cement Creek drainage are both sites of 23-million-year-old acid-sulfate mineralization. The Eureka Graben area on the upper northeast side of the Cement Creek drainage is the site of 18- to 10-million-year-old emplacement of northeast-trending polymetallic veins of silver, lead, zinc, copper, and often gold that formed as fracture or fissure filling material (USGS 2007d).

The Red Mountain and OPAM acid-sulfate hydrothermal systems cover 22 square kilometers and 21 square kilometers, respectively, along the margin of the collapsed Silverton Caldera on the west and northwest side of the Cement Creek Drainage (Figure 2 and 3). Most of the mineralization and mining activity in these two areas has occurred in the Red Mountain area with mines and adits related to the Red Mountain acid-sulfate system found in Prospect, Dry, Georgia, and Corkscrew Gulches, all tributaries of Cement Creek. The ores from these mines commonly contain enargite (Cu_3AsS^4), galena (PbS), chalcocite (Cu_2S), tetrahedrite ($(Cu,Fe)_{12}(Sb,As)_4S_{13}$), stromeryite (AgCuS), bornite (Cu_5FeS_4), chalcopyrite ($CuFeS_2$), and pyrite (FeS_2) along with elemental arsenic (As), copper (Cu), lead (Pb), and iron (Fe) (USGS 2007d).

Mineralization in the veins of the Eureka Graben that is drained by upper Cement Creek include massive pyrite and milky quartz (FeS_2—$Si0_2$), chalcopyrite ($CuFeS_2$), galena (PbS), sphalerite (ZnS), fluorite (CaF), and elemental gold (Au), and silver (Ag) (USGS 2007d).

The San Juan Mountains were nearly covered by alpine glaciers during the latest Pleistocene Pinedale glaciation. The thickness of glacial ice is estimated to have ranged from approximately 1,400 feet thick at Gladstone to 1,700 feet thick at Silverton. The Pinedale glaciation ended approximately 12,000 years ago, and except for the glacial till deposits, all surface sediments along Cement Creek were likely deposited after that date (USGS 2007e). Approximately 6,000 years ago, Cement Creek cut into the creek bed sediments by as much as 16 feet, causing a drop in the valley bottom shallow water table aquifer. Beginning about A.D. 400, Cement Creek aggraded the stream bed by as much as 10 feet, then between A.D. 1300 and A.D. 1700, Cement Creek cut back to the previous level established approximately 6,000 years ago. These changes in the shallow water table elevations in the valley caused mineralization and cementation of the sediments in the stream course (USGS 2007e).

Recent human activities have had relatively little influence on the overall shape and physical processes of Cement Creek (USGS 2007e).

Groundwater in the Cement Creek area is found in cracks and fissures in the near surface of the igneous rocks that comprise the majority of the area.

3.3.3 Hydrologic Setting

The drainage area of Cement Creek is 20.1 square miles (USGS 2007b). Cement Creek flows through the middle of the old caldera, with the period of high flow being May, June, and July, in response to snowmelt in the San Juan Mountains, and the periods of low flow occurring in later winter and late summer (EPA 1999). The average flow measured by the USGS on Cement Creek at Silverton before the confluence with the Animas River at station number 09358550 (also known as CC48) between 1992 and 2008 (excluding 1994) was 38.3 cubic feet per second (cfs). The highest average flow on Cement Creek was 56.3 cfs during 1995 and the lowest was 17 cfs during the drought of 2002 (USGS 2009). The drainage area of the Animas River is 146 square miles (USGS 2007b). The average flow measured by the USGS on the Animas River below Silverton at station number 09359020 (also known as A72) between 1992 and 2008 was 281 cfs (USGS 2009).

3.3.4 Meteorology

The Upper Animas River Basin and Cement Creek are located in an alpine climate zone. The average annual precipitation in the area is about 40 inches (National Oceanic and Atmospheric Administration [NOAA] 1973). Winter snowfall is heavy, and severe rain storms occur in the summer (USGS 1969). The average total precipitation for Silverton, Colorado as totaled from the Western Regional Climate Center database is 24.50 inches. The 2-year, 24-hour rainfall event for this area is 2 inches NOAA 1973).

4.0 PRELIMINARY PATHWAY ANALYSIS

4.1 WASTE CHARACTERIZATION

Thirty-three individual sources of mine wastes have been identified in the Cement Creek drainage, totaling approximately 188,000 cubic yards. Several sources of mine waste have been reclaimed to some degree through work carried out by the Bureau of Land Management (BLM), the CDPHE, the Colorado Division of Reclamation Mining and Safety (DRMS), and the Animas River Stakeholders Group (ARSG). The reclaimed waste areas are primarily in Prospect Gulch and Georgia Gulch, both of which feed into lower Cement Creek (below Gladstone). This investigation will focus on sources of mine waste in upper Cement Creek, including the North Fork of Cement Creek. These sources of waste include the Gold King 7 Level Mine, the Queen Anne Mine, the Grand Mogul Mine, the Mogul Mine, the Mogul North Mine, the Red and Bonita Mine, the American Tunnel discharge, and to a lesser degree, the Adelphin and Columbia Mines. These locations are shown on Figures 2 and 3. In addition, stained soil was observed at the Henrietta Mine during the course of a removal action conducted by the BLM and PanEnergy. The staining may be attributed to oil which leaked from equipment used at the site (EPA 2010). This observation, along with anecdotal evidence, indicates that oil-containing equipment was used at some of the mines in the area and may have included underground use (EPA 2010). Due to the time frames in which potentially PCB-containing equipment was used, this SR will include analyzing source and sediment samples for PCBs.

4.2 GROUNDWATER PATHWAY

The Town of Silverton does not have a municipal intake on Cement Creek or the Animas River, but obtains its drinking water supply from Bear and Boulder Creeks. Bear Creek is located in unmineralized terrain of the Mineral Creek drainage west-southwest of Silverton between Bear and Sultan Mountains. Boulder Creek flows into the Animas River northeast of Silverton after it passes around the Mayflower Tailings Ponds via a diversion (USGS 1955, Town of Silverton 2009). The Town of Silverton does not utilize groundwater (Town of Silverton 2009).

A review of the groundwater well records for wells in the Cement Creek drainage maintained by the State of Colorado Division of Water Resources identified seven domestic or household use wells. A summary of the well data is presented below in Table A (Colorado Division of Water Resources 2009a). The average number of residents per household in San Juan County is 2.06, which indicates that approximately 14 people potentially use groundwater for domestic or household purposes in the Cement Creek drainage (U.S. Census Bureau 2009). At this time, it is not known if the wells in the Cement Creek drainage are used for obtaining drinking water on a year-round basis.

TABLE A
Domestic and Household Groundwater Wells in the Cement Creek Drainage

Well Number	Well Permit Number	Use
1	127569	Household
2	279290	Domestic
3	275041	Domestic
4	116475	Household
5	258508	Domestic
6	115734	Household
7	81579	Domestic

4.3 SURFACE WATER PATHWAY

The surface water pathway is the pathway most impacted by mining and milling activities in the Cement Creek drainage. Millions of tons of mine and mill waste were dumped directly into the area streams as a normal operating practice between 1890 and 1935 and to a far lesser extent until 1991 (USGS 2007c). The fine-grained material has had ample opportunity to spread downstream and contaminate stream sediment in the Animas River.

Surface water and stream sediments for a 1996 EPA-funded SI that included the Cement Creek drainage were collected by the CDPHE and analyzed by a Contract Laboratory Program (CLP) laboratory. However, the analytical data were determined not to have the necessary validation and location data to be used for HRS scoring purposes.

There are no surface water intakes along the Animas River within the 15-mile downstream limit for drinking water, agricultural, or industrial use, and the first use of surface water below the confluence of Cement Creek with the Animas River is the Tall Timber Ditch Alternative Point 17 miles downstream that is historically used for irrigation and is owned by Beggrow Enterprises of Durango, Colorado (Colorado Division of Water Resources 2009b). The Animas River is used for occasional sport recreational use, e.g., rafting, within the 15-mile downstream limit, but the relative inaccessibility of the river along much of the stream course mitigates against active recreational use along the entire stretch (Mild to Wild Rafting 2009). Drinking water for the town of Silverton is taken from Bear Creek in the Mineral Creek and from Boulder Creek in the Animas River drainage outside the area of influence of Cement Creek (Town of Silverton 2009).

Cement Creek itself does not harbor any aquatic life; however, the Animas River below Silverton is stocked and fished (Colorado Division of Wildlife 2009). Rainbow, brook, and native trout are caught in the Animas River below Silverton and consumed by humans (Outdoor World 2009). Elk Park which is approximately 5 miles downstream of Silverton on the Animas River and accessible only by foot was specifically identified as a location where fishermen catch and consume fish (Outdoor World 2009).

Approximately 2,500 feet of streamside wetlands are found along Cement Creek (U.S. Department of the Interior, Fish and Wildlife Service [USDOI] 1998a, 1998c). Iron bogs are found along the middle stretch of Cement Creek. Approximately 3 miles of palustrine and riverine streamside wetlands are found along the 15-mile downstream segment of the Animas River below the probable point of entry (PPE) of Cement Creek with the Animas River (USDOI 1998b, 1998d).

4.4 SOIL EXPOSURE

The USGS has identified 33 separate mine waste rock dump sites in the Cement Creek drainage. There is often no specific information available as to the accessibility of each individual waste rock dump, but generally such features are not fenced, and access can by gained by recreationalists, vacationers, rock hounds, tourists, and local residents. Reclamation work has been conducted at seven of the sites, and in six cases involved the consolidations of waste material and the construction of engineered controls to prevent dispersal of contaminants. Approximately 120,000 yards of waste and tailings were removed from the American Tunnel waste dump and the Lead Carbonate Mill site and deposited in the Mayflower Tailings pond #4 (Animas River Stakeholders Group [ARSG] 2007). San Juan County is a popular vacation destination for outdoor activities such as hiking, four-wheel driving, rock collecting, and skiing that could take place on contaminated ground. The Silverton Mountain Ski Resort is located on Storm Peak where many of the mines in the area are located (Figure 3).

There are several undocumented residences in the Cement Creek drainage, but there is no record of any schools or day care facilities. Workers are present at the Silverton Ski Area on Storm Peak and possibly in maintenance roles at some rehabilitated structures in Gladstone.

The southwestern willow flycatcher is a federally and state-listed endangered species in San Juan County, but is not found at this elevation. The lynx, which has been observed in the area, is a federally listed threatened and state-listed endangered species, and the Boreal toad is a state-listed endangered species (Colorado Division of Wildlife 2010a, 2010b). The Boreal toad could live in wetlands adjacent to the stream (Colorado Department of Wildlife 2010b).

4.5 AIR PATHWAY

The air pathway will not evaluated as a part of this site reassessment because of the reportedly very low population density in the Cement Creek drainage and the fact that the ground surface is snow covered for at least 6 months of the year.

5.0 DATA QUALITY OBJECTIVES PROCESS

The EPA Data Quality Objectives (DQO) Process is a seven-step systematic planning approach to develop acceptance or performance criteria for EPA-funded projects. The seven steps of the DQO process are:

- Step 1 The Problem Statement;
- Step 2 Identifying the Decision;
- Step 3 Identifying the Decision Inputs;
- Step 4 Defining the Study Boundaries;
- Step 5 Developing a Decision Rule;
- Step 6 Defining Tolerance Limits on Decision Errors; and
- Step 7 Optimizing the Sample Design.

These DQOs were developed by UOS based on information provided by the TDD and the EPA "Guidance for the Data Quality Objectives Process" (EPA 2000).

Based upon the potential risks associated with the potential hazardous substances, the project team identified surface water as the pathway of potential concern with regard to the Cement Creek drainage within the Upper Animas Mining District.

TABLE B
Data Quality Objectives Seven-Step Planning Approach

Step 1 Problem Statement	Step 2 Identifying the Decisions	Step 3 Decision Inputs	Step 4 Study Boundaries	Step 5 Decisions Rules	Step 6 Tolerance Limits on Errors	Step 7 Optimization of Sample Design
The question to be resolved by this SR is whether any contamination from the sources of mine waste in upper Cement Creek migrated into the environment where it is impacting potential environmental and/or human health targets. The sources from the upper Cement Creek mine sites may affect the surface water in Cement Creek and the Animas River. Mining impacted surface water from Cement Creek sources may impact Cement Creek and Animas River wetlands. Impacts to water quality from Cement Creek sources may be impacting Animas River fisheries.	Historic information about the upper Cement Creek mine sites poses a concern for the likelihood of release of heavy metal contamination and the potential for release of PCBs into Cement Creek and the Animas River. The primary goal for this SR is to determine if there is contamination and the extent of surface water and sediment contamination and, if contamination is found, determine if it is attributable to the upper Cement Creek mine sites, and which mines are contributing the most. The primary study questions for this investigation are: (1) Do Cement Creek mine waste piles and draining adits contain elevated concentrations of metals?; (2) Are the nearby surface waters and associated sediment (i.e., Cement Creek and the Animas River impacted by the sources at the former mines?; and (3) Do sample concentrations exceed applicable benchmarks? (4) If elevated metals and PCBs are identified, are the elevated constituents attributable to Cement Creek sources?	There are two media at the upper Cement Creek drainage, surface water and sediment, that may contain contamination that may pose a risk to the environment or human health. The potential source locations include waste rock/tailings piles, the discharge from the adits of the upper Cement Creek mines, and surface water flow from the waste piles. Samples will be analyzed for TAL metals. In addition to metals contamination, the potential exists for PCB contamination at the mines due to equipment use. Selected source and sediment samples will be analyzed for PCBs in addition to metals. The following data will be used to guide decision-making at the site: • Field data and documented observations from surface water, sediment, surface soil (source) sampling, and mine drainage (aqueous source) sampling ; • Analytical data from surface water, sediment, and surface soil (source), and mine drainage (aqueous source) samples to determine if contaminants from the upper Cement Creek mine sites have migrated; • Identification and documentation of environmental and human health targets potentially impacted by migration of contaminants from the upper Cement Creek mine sites into surface water, and sediment; and • Comparison of analytical results to MCLs, EPA Regional Screening Levels (RSLs), applicable Superfund Chemical Data Matrix (SCDM) benchmarks, and background levels.	The pathway of concern at the Upper Animas Mining District site is the Surface Water Pathway in Cement Creek and the Animas River. Potential human health and environmental targets of the Upper Animas Mining District site include the wetlands and aquatic environments downstream of the upper Cement Creek Mine sites. Samples to be collected and analyzed include surface water and sediment from Cement Creek, the Animas River, and Mineral Creek. In addition samples will be collected from the adits of the Gold King 7 Level, Red and Bonita, Mogul, Grand Mogul, Queen Anne Mines and the American Tunnel. Soil (source) samples will be collected from the Gold King 7 Level, Red and Bonita, Mogul, North Mogul, Mogul Stope Complex, Grand Mogul, Queen Anne Mines, and Henrietta Mine. Field activities are expected to commence in late October or early November 2010.	The potential receptors at the Upper Animas Mining District site include aquatic habitats and wetlands. Analytical results for soil will be compared to Colorado Soil Evaluation Values (CSEV) for direct exposure to residential and industrial soils. Analytical results for surface water will be compared to Colorado Water Standards and appropriate background samples. Analytical results for sediment will be compared to background sediment results. No benchmarks are established for sediment. Note that some ESAT detection limits are higher than (SCDM), Risk-Based Screening Levels (RBSLs), and/or Soil Screening levels (SSLs) for some substances. If contaminants are detected at the Upper Animas Mining District site at levels below 3 times background for those contaminants, then no removal or remediation needs to be done. If contaminants are present at the property at levels equal to or greater than 3 times background, further evaluation may be needed to further characterize the extent of the contamination.	Background sediment and surface water conditions will be determined. Statistical sampling will not be performed; therefore, tolerance limits will not be calculated. Soil (source) samples will be collected to identify potential contaminants and characterize potential areas of contamination. Surface water and sediment samples will be collected to determine the mine impact on surface water. UOS TSOPs will be followed, and any deviations from the FSP will be documented. Issues requiring corrective actions, if needed, will be documented and reported to the EPA Site Assessment Manager. All data will be reviewed, verified, and validated to ensure that they are acceptable for the intended use.	Sample locations have been selected based upon an understanding of known environmental conditions and required information. The following activities will be performed on site to determine if sample locations must be adjusted and how to proceed with sampling: • Collect surface water and sediment samples to determine the extent of metals in Cement Creek and the Animas River and collect samples appropriately to provide information as to attribution from specific mines or gulches; • Progress from farthest downstream sample location to prevent cross-contamination; • Biased grab sampling will be performed in accordance with the TSOPs and site assessment protocols; • Identify potential human health and sensitive area targets for the Surface Water Pathway • Collect soil (source) samples to characterize waste materials present in mine dumps; • Criteria for data quality parameters are presented in Section 8.0. • Data will follow the regional Instructions for Interim Emergency Response Electronic Data Deliverable and will include the recommended data elements.

6.0 FIELD PROCEDURES

6.1 CONCEPT OF OPERATIONS

6.1.1 Schedule

Field work is scheduled for late October or early November 2010. Sampling is estimated to be completed in approximately 4 to 5 days. Non-sampling data collection will be performed as appropriate (Table 2).

6.1.2 Safety

All field activities will be conducted in strict accordance with an approved UOS Site Health and Safety Plan, which will be developed before the start of field activities. It is anticipated that all field work can be accomplished in Level D personal protective equipment.

6.1.3 Site Access and Logistics

UOS will obtain site access with the assistance, if necessary, of the EPA Region 8 Site Assessment Manager for this site. UOS will have written consent from all applicable property owners (on-site and off-site) prior to the field sampling event.

6.2 SAMPLE LOCATIONS

This SR involves the collection of as many as 166 field samples (Figures 2 and 3) (Tables 1 and 2). These samples will potentially include 69 surface water samples (including adit discharge samples), 61 sediment samples, 36 soil samples (all of which will be source samples). The above numbers include field QA/QC samples. All sample points will be located on a topographic map or with a Global Positioning System (GPS) device after sample collection. This procedure will allow documentation of changes in sample locations as they occur in the field due to unanticipated site conditions.

The samples will be labeled as follows: For example, in sample ID UASW001, UA stands for Upper Animas Mining District site. The matrix will be identified as follows:

- SE = sediment

- SW = surface water
- SO = Soil
- AD = Adit discharge

Sample locations will be numbered sequentially as follows: 001 = sample location 1.

Following sample collection, START will create a sample identification table that will cross-reference the START samples with ARSG and other EPA samples that have been collected from the same latitude/longitude. These data elements will be shared with EPA, the ARSG, and the ESAT contractor who is managing the Upper Animas Scribe database. The START data elements will comply with the regional Instructions for Interim Emergency Response Electronic Data Deliverable and the Recommended Data Elements for Database documents.

As many as 58 co-located surface water and sediment samples will be collected from Cement Creek, the gulches and tunnels contributing to Cement Creek, Mineral Creek, and the Animas River. The sample locations are designed to bracket off each source of water flowing into Cement Creek and the Animas River to allow study of attribution. The background samples for surface water and sediment on Cement Creek will be collected upgradient of the highest mine sites. The background sample on the Animas River will be collected on the Animas River upstream of the confluence with Cement Creek. As many as eight surface water samples will be collected from adit discharges at the Gold King 7 Level Mine, Red and Bonita Mine, Mogul Mine, Grand Mogul Mine, Queen Anne Mine, Adelphin Mine, and Columbia Mine.

As many as 33 grab source samples will be collected from the upper Cement Creek mine sites from the waste rock/tailings piles. As many as five samples each will be collected from the Gold King 7 Level Mine, Red and Bonita Mine, Mogul Mine, Mogul North Mine, Grand Mogul Stope Complex, Grand Mogul Mine, and Queen Anne Mine. If available, as many as three samples each will be collected from Adelphin Mine, Columbia Mine, and the area surrounding the American Tunnel.

6.3 SAMPLING METHODS

6.3.1 Soil Sampling

All of the soil samples will be source samples collected in accordance with procedures described in UOS TSOP 4.16, "Surface and Shallow Depth Soil Sampling" (UOS 2005). Disposable plastic scoops will be used for source sample collection. All source samples will be collected as biased grab samples from the 6- to 12-inch depth interval, if possible. If the ground is too hard to get to the 6-inch depth, then the sample will be dug to a depth that is immediately below the oxidized layer of source material. A sharp shooter shovel may be used to accomplish the depth needed for the sample and decontaminated between samples. Sample descriptions will be logged in the field log book. GPS data will be collected for each sample location.

6.3.2 Surface Water Sampling

Surface water sampling will be conducted according to UOS TSOP 4.18, "Surface Water Sampling," or by immersing the sample bottles directly into the sample media. UOS will measure field parameters, including pH, temperature, and electrical conductivity of each sample, as described in TSOP 4.14, "Water Sample Field Measurements" and Table 6 (UOS 2005). Field instrumentation will be calibrated daily and all calibration and field data will be recorded in the field log book. Sampling will be conducted from the farthest downstream location to the farthest upstream location to minimize the potential for cross-contamination. All surface water sample locations will be photographed and documented during sampling activities. If a surface water sample location is found to be dry, or flow volume is too low to collect a sample, the condition will be photographed and documented in the project log book. If wetlands are observed in the field, they will be assessed to determine if they meet the 40 CFR 230.3 Definition of a Wetland; this information will be entered into the log book (OFR 2005).

6.3.3 Sediment Sampling

Sediment sampling will be conducted according to UOS TSOP 4.17, "Sediment Sampling" (UOS 2005). Sediment sampling locations will correspond to surface water sampling locations (Figures 2 and 3) (Table 1). Sediment sampling will be conducted using a scoop and a sample jar. Sediment sampling will be conducted with surface water sampling and will occur after the surface water sample has been collected, proceeding from the most downstream location to the most upstream location. All sediment sample locations will be photographed and documented during sample activities (UOS 2008).

6.4 CONTROL OF CONTAMINATED MATERIALS

Investigation-derived waste (IDW) generated during the focused SR will be handled in accordance with UOS TSOP 4.8, "Investigation-Derived Waste Management," and the Office of Emergency and Remedial Response (OERR) Directive 9345.3-02, "Management of Investigation Derived Waste During Site Inspections" (UOS 2005, EPA 1991). Disposable sampling equipment and PPE will be bagged, removed from the Site, and disposed of as a non-hazardous solid waste. Nitric acid waste will be neutralized in the field with calcium carbonate, removed from the site, and appropriately disposed.

6.5 ANALYTICAL PARAMETERS

Table 3, the Sample Plan Checklist, lists all sample parameters for the investigation. Aqueous source (adit drainage) samples will be analyzed for TAL dissolved metals and TAL total metals by the EPA Region 8 ESAT laboratory (Table 5). Surface water samples will be analyzed for TAL dissolved metals by the EPA Region 8 ESAT laboratory. All sediment samples will be analyzed for TAL total metals and PCBs by a CLP laboratory. The ESAT reporting limits for metals in water are shown in Table 5. Metals of concern at the site include aluminum, arsenic, cadmium, calcium, copper, iron, lead, magnesium, manganese, molybdenum, zinc, silver, and antimony.

7.0 <u>CHAIN OF CUSTODY</u>

After sample collection and identification, all samples will be handled in strict accordance with the chain-of-custody protocol specified in UOS TSOP 4.3, "Chain of Custody" (UOS 2005).

8.0 <u>MEASUREMENT QUALITY OBJECTIVES</u>

8.1 FIELD QUALITY CONTROL PROCEDURES

All samples will be handled and preserved as described in UOS TSOP 4.2, "Sample Containers, Preservation, and Maximum Holding Times." Calibration of the pH, temperature, and conductivity meters will follow instrument manufacturers' instruction manuals and UOS TSOP 4.14, "Water Sample Field Measurements" (Table 4). Sample collection will progress from downstream to upstream to prevent cross-contamination (UOS 2005).

All non-disposable sampling equipment will be decontaminated prior to initial use. All non-disposable sampling equipment will be decontaminated after the collection of each sample in accordance with UOS TSOP 4.11, "Equipment Decontamination." Basic decontamination will consist of washing or brushing gross particulate off sampling equipment with tap water and a scrub brush, followed by washing equipment with a solution of Liquinox® and distilled water, rinsing with distilled water, rinsing with nitric acid, and finally rinsing with distilled water. After decontamination, the equipment will be allowed to gravity drain (UOS 2005).

The following samples will be collected to evaluate QA at the site in accordance with the "Guidance for Performing Site Inspections under CERCLA," Interim Final September 1992, the "Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA," and the UOS Generic QAPP (EPA 1992, 1993; UOS 2008):

- One duplicate aqueous sample per set of 20 aqueous samples collected or 1 duplicate for each aqueous matrix type. Three will be required for this site.
- Ten triple volume samples (four water samples, three sediment sample, and three soil sample) to be used for a MS/MSD. (The triple volume samples will not be labeled as separate samples.)

The UOS Generic QAPP serves as the primary guide for the integration of QA/QC procedures for the START contract (UOS 2008).

8.2 DATA QUALITY INDICATORS

Data quality assessment to determine data quality and usability will include:

- A QA/QC review of field generated data and observations;
- Individual data validation reports for all sample delivery groups;
- Review of the procedures used by the validator to qualify data for reasons related to dilution, reanalysis, and duplicate analysis of samples;

- Evaluation of QC samples, such as field duplicates/replicates and matrix spike laboratory control samples to assess the quality of the field activities and laboratory procedures;
- Assessment of the quality of data measured and generated in terms of accuracy, precision, and representativeness; and
- Summary of the usability of the data, based upon the assessment of data conducted during the previous steps.

Quality attributes are qualitative and quantitative characteristics of the collected data. The principal quality attributes to environmental studies are precision, bias, representativeness, comparability, completeness, and sensitivity. Data quality indicators (DQIs) are specific indicators of quality attributes.

Performance criteria address the collection of samples, and acceptance criteria address the use of the data collected (EPA 2002). Performance and acceptance criteria will be specified in the project-specific FSP for appropriate data quality indicators. The total allowable errors will be managed to achieve an acceptable level of confidence in the decisions that are made from the data.

8.2.1 Bias

Bias is systematic or persistent distortion of a measurement process that causes errors in one direction. The extent of bias can be determined by an evaluation of laboratory initial calibration/continuing calibration verification, laboratory control spike/laboratory control spike duplicates, blank spike, MS/MSD, and Method Blank.

8.2.2 Sensitivity

Sensitivity generally refers to the capability of a method or instrument to discriminate between small differences in analyte concentration and is generally discussed as detection limits. Before sampling begins it is important to compare detection limits and project requirements in order to select a method with the necessary detection limits to meet the project goals.

8.2.3 Precision

Precision is the measure of agreement among repeated measurements of the same property under identical, or substantially similar, conditions and is expressed as the relative percent difference (RPD) between the sample pairs.

8.2.4 Representativeness

Representativeness is the measure of the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, a process condition, or an environmental condition. Representativeness encompasses both the degree to which measurements reflect the actual concentration, and the degree to which sampling units reflect the population they represent. The effect of representativeness should be considered on two levels: within the sample unit and between sample units. A discussion of representativeness should include adherence to TSOPs for sampling procedures, field and laboratory QA/QC procedures, appropriateness of sample material collected, compositing to increase sample representativeness, homogenization, analytical method and sample preparation, and achievement of Measurement Quality Objectives (MQOs) for the project.

8.2.5 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. The actual percentage of completeness is less important than the effect of completeness on the data set.

8.2.6 Comparability

Comparability is the qualitative term that expresses the confidence that two data sets can contribute to common interpretation and analysis and is used to describe how well samples within a data set, as well as two independent data sets, are interchangeable

9.0 ANALYTICAL RESULTS REPORTING

UOS will prepare a Sampling Activities Report (SAR) in accordance with the TDD for this project. An Analytical Results Report (ARR) is scheduled to be submitted within 6 weeks after the receipt of the validated analytical results as per the TDD for this project. Data validation will be conducted by EPA

Region 8 or a UOS-contracted validator. The SAR and ARR will conform to the "Guidance for Performing Site Inspections under CERCLA," Interim Final September 1992 and the "Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA" (EPA 1992, 1993).

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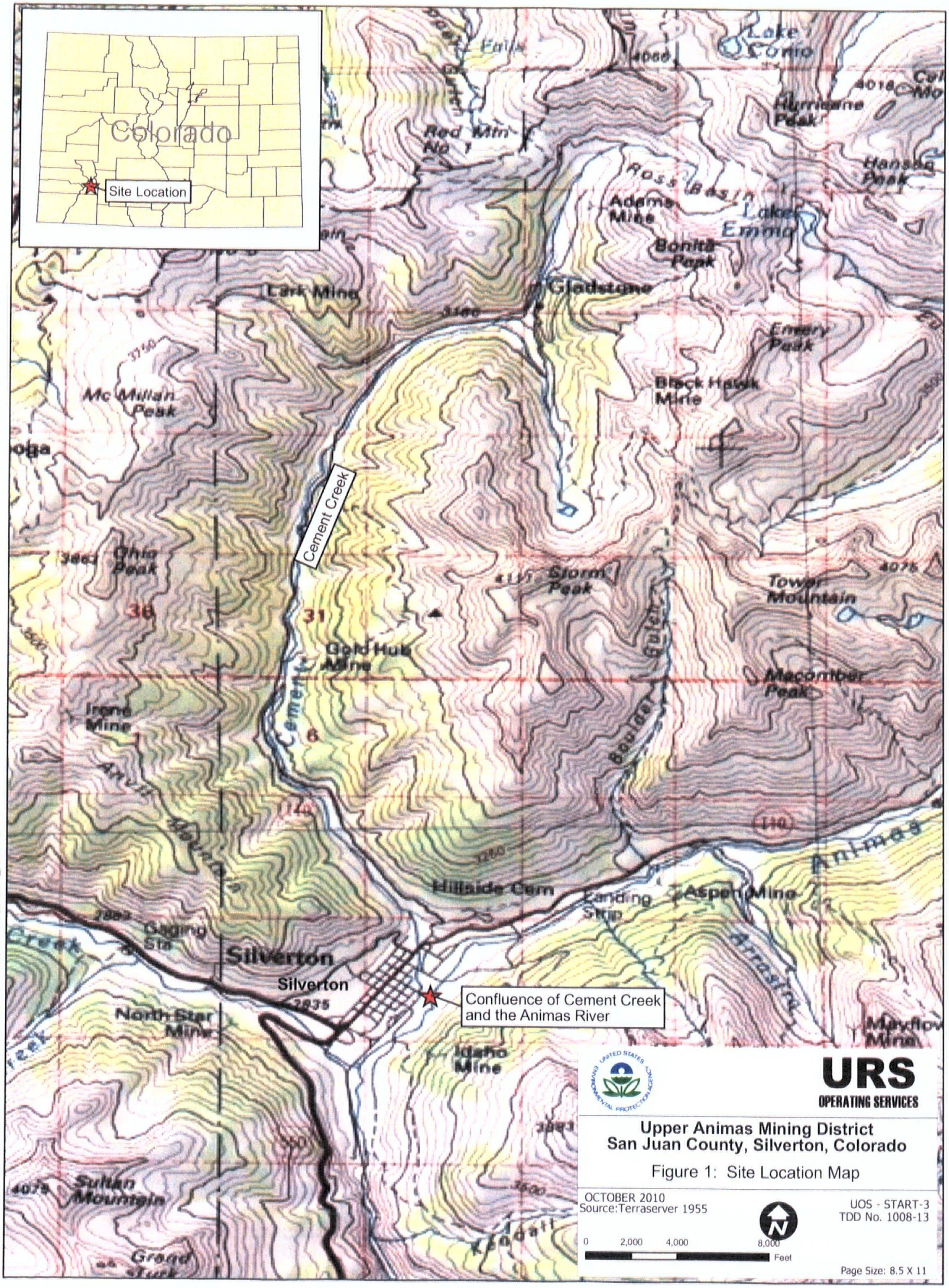

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TARGET SHEET

EPA REGION VIII

SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOCUMENT NUMBER: 1260055

SITE NAME: UPPER CEMENT CREEK, UPPER ANIMAS MINING DISTRICT

DOCUMENT DATE: 10/21/2010

DOCUMENT NOT SCANNED

Due to one of the following reasons:

- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
- ☑ OVERSIZED
- ☐ AUDIO/VISUAL
- ☐ PERMANENTLY BOUND DOCUMENTS
- ☐ POOR LEGIBILITY
- ☐ OTHER
- ☐ NOT AVAILABLE
- ☐ TYPES OF DOCUMENTS NOT TO BE SCANNED (Data Packages, Data Validation, Sampling Data, CBI, Chain of Custody)

DOCUMENT DESCRIPTION:

FIGURE 2: UPPER CEMENT CREEK SITE DETAILS MAP
FIGURE 3: CEMENT CREEK SITE DETAILS MAP

Contact the Superfund Records Center to view available document.
(303) 312-6473

TABLE 1
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water	UASW004	Cement Creek downstream of the confluence with the South Fork of Cement Creek	Determine the impact of the South Fork of Cement Creek on Cement Creek
Surface Water	UASW005	South Fork of Cement Creek	Determine contaminant concentrations in South Fork of Cement Creek
Surface Water	UASW006	Cement Creek downstream of the American Tunnel and upstream of the confluence with the South Fork of Cement Creek	Determine the impact of the American Tunnel discharge on Cement Creek
Surface Water	UASW007	Discharge from the American Tunnel immediately above confluence with Cement Creek	Determine contaminant concentrations in the American Tunnel Discharge
Surface Water	UASW008	Cement Creek upstream of the American Tunnel	Determine contaminant concentrations in Cement Creek upstream of the confluence with the American Tunnel discharge
Surface Water	UASW009	Cement Creek downstream of the confluence with the North Fork of Cement Creek	Determine the impact of the North Fork of Cement Creek on Cement Creek
Surface Water	UASW010	North Fork of Cement Creek upstream of the confluence with Cement Creek	Determine contaminant concentrations in the North Fork of Cement Creek
Surface Water	UASW011	North Fork of Cement Creek downstream of the Gold King 7 Level Mine	Determine the impact of the Gold King 7 Level Mine on Cement Creek
Surface Water	UASW012	North Fork of Cement Creek upstream of the Gold King 7 Level Mine	Determine background in the North Fork of Cement Creek above Gold King 7 Level
Surface Water	UASW013	Cement Creek upstream of the confluence with the North Fork of Cement Creek	Determine contaminant concentrations in Cement Creek upstream of the confluence with the North Fork of Cement Creek
Surface Water	UASW014	Cement Creek downstream of Red and Bonita Mine	Determine the impact of Red and Bonita Mine on Cement Creek
Surface Water	UASW015	Drainage channel adjacent to county road below Red and Bonita	Determine contaminant concentrations at the base of the Red and Bonita piles
Surface Water	UASW016	Cement Creek upstream of Red and Bonita Mine	Determine contaminant concentrations in Cement Creek prior to the addition of Red and Bonita discharge
Surface Water	UASW017	Cement Creek downstream of wetland that channels Mogul Mine drainage	Determine the impact of Mogul Mine drainage on Cement Creek

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water	UASW018	Cement Creek upstream of wetland that contains Mogul Mine drainage	Determine contaminant concentrations in Cement Creek upstream of Mogul Mine
Surface Water	UASW019	Mogul Mine drainage	Determine contaminant concentrations in Mogul Mine drainage
Surface Water	UASW020	Cement Creek upstream of Mogul Mine	Determine contaminant concentrations in Cement Creek upstream of Mogul Mine drainage
Surface Water	UASW021	Cement Creek downstream of Mogul North Mine	Determine the impact of Mogul North Mine on Cement Creek
Surface Water	UASW022	Mogul North Mine discharge	Determine contaminant concentrations in Mogul North Mine discharge
Surface Water	UASW023	Cement Creek upstream of Mogul North Mine	Determine contaminant concentrations in Cement Creek tributary upstream of Mogul North Mine
Surface Water	UASW024	Cement Creek upstream of confluence with Lower Ross Basin Drainage	Determine contaminant concentration in Cement Creek upstream of Lower Ross Creek Basin Drainage
Surface Water	UASW025	Cement Creek downstream of Queen Anne Mine	Determine contaminant concentrations in Cement Creek downstream of Queen Anne Mine and upstream of Mogul Mine
Surface Water	UASW026	Cement Creek upstream of Queen Anne Mine and downstream of Columbia Mine	Determine contaminant concentrations upstream of Queen Anne Mine and downstream of Columbia Mine
Surface Water	UASW027	Cement Creek upstream of Columbia Mine	Determine background concentrations in Cement Creek above Columbia Mine
Surface Water	UASW028	Lower Ross Basin Drainage downstream of Grand Mogul Mine	Determine contaminant concentrations in Lower Ross Basin Drainage downstream of Grand Mogul Mine and upstream of Mogul Mine and contribution from Queen Anne Mine
Surface Water	UASW029	Discharge from the Grand Mogul Mine	Determine contaminant concentrations in Grand Mogul Mine drainage
Surface Water	UASW030	Lower Ross Basin Drainage upstream of Grand Mogul Mine	Determine contaminant concentrations in Lower Ross Basin Drainage downstream of Adelphin Mine and upstream of Grand Mogul Mine
Surface Water	UASW031	Lower Ross Basin Drainage upstream of Adelphin Mine	Determine background concentrations above Adelphin Mine

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water	UASW032	Animas River downstream of the confluence with Mineral Creek	Determine the impact of Mineral Creek on the Animas River
Surface Water	UASW033	Mineral Creek upstream of the confluence with the Animas River	Determine contaminant concentrations in Mineral Creek
Surface Water	UASW034	Animas River upstream of the confluence with Mineral Creek	Determine contaminant concentrations in the Animas River upstream of the confluence with Mineral Creek
Surface Water	UASW035	Cement Creek downstream of the Kendrick-Gelder Smelter	Determine the impact of the Kendrick-Gelder smelter on Cement Creek
Surface Water	UASW036	Cement Creek upstream of the Kendrick-Gelder Smelter	Determine contaminant concentrations in Cement Creek upstream of Kendrick-Gelder Smelter
Surface Water	UASW037	Cement Creek downstream of the Illinois Gulch drainage	Determine the impact of Illinois Gulch drainage on Cement Creek
Surface Water	UASW038	Illinois Gulch drainage	Determine contaminant concentrations in Illinois Gulch drainage
Surface Water	UASW039	Cement Creek upstream of the confluence with Illinois Gulch drainage and downstream of Ohio Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Illinois Gulch drainage and downstream of Ohio Gulch drainage
Surface Water	UASW040	Ohio Gulch drainage	Determine contaminant concentrations in Ohio Gulch drainage
Surface Water	UASW041	Cement Creek upstream of the confluence with Ohio Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Ohio Gulch drainage
Surface Water	UASW042	Cement Creek downstream of the Anglo Saxon Mine drainage	Determine the impact of Anglo Saxon Mine drainage on Cement Creek
Surface Water	UASW043	Anglo Saxon Mine drainage	Determine contaminant concentrations in Anglo Saxon Mine drainage
Surface Water	UASW044	Cement Creek upstream of the Anglo Saxon Mine and downstream of Minnesota Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of the Anglo Saxon Mine and downstream of Minnesota Gulch drainage
Surface Water	UASW045	Minnesota Gulch drainage	Determine contaminant concentrations in Minnesota Gulch drainage
Surface Water	UASW046	Cement Creek upstream of the confluence with Minnesota Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Minnesota Gulch drainage
Surface Water	UASW047	Cement Creek downstream of the Elk Tunnel and Fairview Gulch	Determine the impact of the Elk Tunnel and Fairview Gulch on Cement Creek

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water	UASW048	Elk Tunnel Discharge	Determine contaminant concentrations in Elk Tunnel Discharge
Surface Water	UASW049	Cement Creek upstream of the confluence with Fairview Gulch and the Elk Tunnel discharge	Determine contaminant concentrations in Cement Creek upstream of Fairview Gulch and the Elk Tunnel Discharge
Surface Water	UASW050	Cement Creek downstream of the Mammoth Tunnel	Determine the impact of the Mammoth Tunnel on Cement Creek
Surface Water	UASW051	Mammoth Tunnel Discharge	Determine contaminant concentrations in Mammoth Tunnel Discharge
Surface Water	UASW052	Cement Creek upstream of the confluence with the Mammoth Tunnel Discharge	Determine contaminant concentrations in Cement Creek upstream of the Mammoth Tunnel Discharge
Surface Water	UASW053	Cement Creek downstream of the Prospect Gulch drainage	Determine the impact of Prospect Gulch drainage on Cement Creek
Surface Water	UASW054	Prospect Gulch drainage	Determine contaminant concentrations in Prospect Gulch drainage
Surface Water	UASW055	Cement Creek upstream of the confluence with Prospect Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Prospect Gulch drainage
Surface Water	UASW056	Cement Creek downstream of the Dry Gulch drainage	Determine the impact of Dry Gulch drainage on Cement Creek
Surface Water	UASW057	Dry Gulch drainage	Determine contaminant concentrations in Dry Gulch drainage
Surface Water	UASW058	Cement Creek upstream of the confluence with Dry Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Dry Gulch drainage
Surface Water	UASW059	Animas River upstream of the confluence with Cement Creek	Establish background concentrations in the Animas River
Surface Water	UASW060	Animas River downstream of the confluence with Cement Creek	Determine the impact of Cement Creek on the Animas River and the fisheries it supports
Surface Water	UASW061	Cement Creek immediately upstream of the confluence with the Animas River	Determine contaminant concentrations in Cement Creek immediately upstream of the confluence with Animas River
Surface Water	UAAD001	American Tunnel discharge (at portal)	Determine contaminant concentrations in American Tunnel Discharge
Surface Water	UAAD002	Upper Gold King 7 Level Mine adit discharge	Determine contaminant concentrations in Gold King 7 Level Mine adit Discharge

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water	UAAD003	Red and Bonita Mine adit discharge	Determine contaminant concentrations in Red and Bonita Mine adit Discharge
Surface Water	UAAD004	Mogul Mine adit discharge	Determine contaminant concentrations in Mogul Mine adit Discharge
Surface Water	UAAD005	Grand Mogul Mine adit discharge	Determine contaminant concentrations in Grand Mogul Mine adit Discharge
Surface Water	UAAD006	Queen Anne Mine adit discharge	Determine contaminant concentrations in Queen Anne Mine adit Discharge
Surface Water	UAAD007	Opportunity sample: Adelphin Mine adit discharge	Determine contaminant concentrations in Adelphin Mine adit Discharge
Surface Water	UAAD008	Opportunity sample: Columbia Mine adit discharge	Determine contaminant concentrations in Columbia Mine adit Discharge
Surface Water	UASW097	Duplicate Sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.
Surface Water	UASW098	Duplicate Sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.
Surface Water	UASW099	Duplicate Sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.
Sediment	UASE004	Cement Creek downstream of the confluence with the South Fork of Cement Creek	Determine the impact of the South Fork of Cement Creek on Cement Creek
Sediment	UASE005	South Fork of Cement Creek	Determine contaminant concentrations in South Fork of Cement Creek
Sediment	UASE006	Cement Creek downstream of the American Tunnel and upstream of the confluence with the South Fork of Cement Creek	Determine the impact of the American Tunnel discharge on Cement Creek
Sediment	UASE007	Discharge from the American Tunnel immediately above confluence with Cement Creek	Determine contaminant concentrations in the American Tunnel Discharge

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Sediment	UASE008	Cement Creek upstream of the American Tunnel	Determine contaminant concentrations in Cement Creek upstream of the confluence with the American Tunnel discharge
Sediment	UASE009	Cement Creek downstream of the confluence with the North Fork of Cement Creek	Determine the impact of the North Fork of Cement Creek on Cement Creek
Sediment	UASE010	North Fork of Cement Creek upstream of the confluence with Cement Creek	Determine contaminant concentrations in the North Fork of Cement Creek
Sediment	UASE011	North Fork of Cement Creek downstream of the Gold King 7 Level Mine	Determine the impact of the Gold King 7 Level Mine on Cement Creek
Sediment	UASE012	North Fork of Cement Creek upstream of the Gold King 7 Level Mine	Determine background concentrations in the North Fork of Cement Creek above Gold King 7 Level
Sediment	UASE013	Cement Creek upstream of the confluence with the North Fork of Cement Creek	Determine contaminant concentrations in Cement Creek upstream of the confluence with the North Fork of Cement Creek
Sediment	UASE014	Cement Creek downstream of Red and Bonita Mine	Determine the impact of Red and Bonita Mine on Cement Creek
Sediment	UASE015	Drainage channel adjacent to county road below Red and Bonita Mine	Determine contaminant concentrations at the base of the Red and Bonita piles
Sediment	UASE016	Cement Creek upstream of Red and Bonita Mine	Determine contaminant concentrations in Cement Creek upstream of Red and Bonita discharge
Sediment	UASE017	Cement Creek downstream of wetland that channels Mogul Mine drainage	Determine the impact of Mogul Mine drainage on Cement Creek
Sediment	UASE018	Cement Creek upstream of wetland that contains Mogul Mine drainage	Determine contaminant concentrations in Cement Creek prior upstream of Mogul Mine
Sediment	UASE019	Mogul Mine drainage	Determine contaminant concentrations in Mogul Mine drainage
Sediment	UASE020	Cement Creek upstream of Mogul Mine	Determine contaminant concentrations in Cement Creek upstream of Mogul Mine drainage
Sediment	UASE021	Cement Creek downstream of Mogul North Mine	Determine the impact of Mogul North Mine on Cement Creek
Sediment	UASE022	Mogul North Mine discharge	Determine contaminant concentrations in Mogul North Mine discharge

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Sediment	UASE023	Cement Creek upstream of Mogul North Mine	Determine contaminant concentrations in Cement Creek tributary upstream of Mogul North Mine
Sediment	UASE024	Cement Creek upstream of confluence with Lower Ross Basin Drainage	Determine contaminant concentration in Cement Creek upstream of Lower Ross Creek Basin Drainage
Sediment	UASE025	Cement Creek downstream of Queen Anne Mine	Determine contaminant concentrations in Cement Creek downstream of Queen Anne Mine and upstream of Mogul Mine
Sediment	UASE026	Cement Creek upstream of Queen Anne Mine and downstream of Columbia Mine	Determine contaminant concentrations upstream of Queen Anne Mine and downstream of Columbia Mine
Sediment	UASE027	Cement Creek upstream of Columbia Mine	Determine background concentrations in Cement Creek above Columbia Mine
Sediment	UASE028	Lower Ross Basin Drainage downstream of Grand Mogul Mine	Determine contaminant concentrations in Lower Ross Basin Drainage downstream of Grand Mogul Mine and upstream of Mogul Mine and contribution from Queen Anne Mine
Sediment	UASE029	Discharge from the Grand Mogul Mine	Determine contaminant concentrations in Grand Mogul Mine drainage
Sediment	UASE030	Lower Ross Basin Drainage upstream of Grand Mogul Mine	Determine contaminant concentrations in Lower Ross Basin Drainage downstream of Adelphin Mine and upstream of Grand Mogul Mine
Sediment	UASE031	Lower Ross Basin Drainage upstream of Adelphin Mine	Determine background concentrations above Adelphin Mine
Sediment	UASE032	Animas River downstream of the confluence with Mineral Creek	Determine the impact of Mineral Creek on the Animas River
Sediment	UASE033	Mineral Creek upstream of the confluence with the Animas River	Determine contaminant concentrations in Mineral Creek
Sediment	UASE034	Animas River upstream of the confluence with Mineral Creek	Determine contaminant concentrations in the Animas River upstream of the confluence with Mineral Creek
Sediment	UASE035	Cement Creek downstream of the Kendrick-Gelder Smelter	Determine the impact of the Kendrick-Gelder smelter on Cement Creek
Sediment	UASE036	Cement Creek upstream of the Kendrick-Gelder Smelter	Determine contaminant concentrations in Cement Creek upstream of Kendrick-Gelder Smelter

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Sediment	UASE037	Cement Creek downstream of the Illinois Gulch drainage	Determine the impact of Illinois Gulch drainage on Cement Creek
Sediment	UASE038	Illinois Gulch drainage	Determine contaminant concentrations in Illinois Gulch drainage
Sediment	UASE039	Cement Creek upstream of the confluence with Illinois Gulch drainage and downstream of Ohio Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Illinois Gulch drainage and downstream of Ohio Gulch drainage
Sediment	UASE040	Ohio Gulch drainage	Determine contaminant concentrations in Ohio Gulch drainage
Sediment	UASE041	Cement Creek upstream of the confluence with Ohio Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Ohio Gulch drainage
Sediment	UASE042	Cement Creek downstream of the Anglo Saxon Mine drainage	Determine the impact of Anglo Saxon Mine drainage on Cement Creek
Sediment	UASE043	Anglo Saxon Mine drainage	Determine contaminant concentrations in Anglo Saxon Mine drainage
Sediment	UASE044	Cement Creek upstream of the Anglo Saxon Mine and downstream of Minnesota Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of the Anglo Saxon Mine and downstream of Minnesota Gulch drainage
Sediment	UASE045	Minnesota Gulch drainage	Determine contaminant concentrations in Minnesota Gulch drainage
Sediment	UASE046	Cement Creek upstream of the confluence with Minnesota Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Minnesota Gulch drainage
Sediment	UASE047	Cement Creek downstream of the Elk Tunnel and Fairview Gulch	Determine the impact of the Elk Tunnel and Fairview Gulch on Cement Creek
Sediment	UASE048	Elk Tunnel Discharge	Determine contaminant concentrations in Elk Tunnel Discharge
Sediment	UASE049	Cement Creek upstream of the confluence with Fairview Gulch and the Elk Tunnel discharge	Determine contaminant concentrations in Cement Creek upstream of Fairview Gulch and the Elk Tunnel Discharge
Sediment	UASE050	Cement Creek downstream of the Mammoth Tunnel	Determine the impact of the Mammoth Tunnel on Cement Creek
Sediment	UASE051	Mammoth Tunnel Discharge	Determine contaminant concentrations in Mammoth Tunnel Discharge
Sediment	UASE052	Cement Creek upstream of the confluence with the Mammoth Tunnel Discharge	Determine contaminant concentrations in Cement Creek upstream of the Mammoth Tunnel Discharge

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Sediment	UASE053	Cement Creek downstream of the Prospect Gulch drainage	Determine the impact of Prospect Gulch drainage on Cement Creek
Sediment	UASE054	Prospect Gulch drainage	Determine contaminant concentrations in Prospect Gulch drainage
Sediment	UASE055	Cement Creek upstream of the confluence with Prospect Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Prospect Gulch drainage
Sediment	UASE056	Cement Creek downstream of the Dry Gulch drainage	Determine the impact of Dry Gulch drainage on Cement Creek
Sediment	UASE057	Dry Gulch drainage	Determine contaminant concentrations in Dry Gulch drainage
Sediment	UASE058	Cement Creek upstream of the confluence with Dry Gulch drainage	Determine contaminant concentrations in Cement Creek upstream of Dry Gulch drainage
Sediment	UASE059	Animas River upstream of the confluence with Cement Creek	Determine background concentrations in the Animas River
Sediment	UASE060	Animas River downstream of the confluence with Cement Creek	Determine the impact of Cement Creek on the Animas River and the fisheries it supports
Sediment	UASE061	Cement Creek immediately upstream of the confluence with the Animas River	Determine contaminant concentrations in Cement Creek immediately upstream of the confluence with Animas River
Sediment	UASE097	Duplicate Sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.
Sediment	UASE098	Duplicate Sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.
Sediment	UASE099	Duplicate Sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.
Soil	UASO001-UASO003	Waste rock from Gold King 7 Level Mine	Characterize source at Gold King 7 Level Mine

TABLE 1, cont.
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Soil	UASO004 - UASO006	Waste rock from Red and Bonita Mine	Characterize source at Red and Bonita Mine
Soil	UASO010- UASO012	Waste rock from Mogul Mine	Characterize source at Mogul Mine
Soil	UASO013 – UASO015	Waste rock from Mogul North Mine	Characterize source at Mogul North Mine
Soil	UASO016 – UASO018	Waste rock from Grand Mogul Stope Complex	Characterize source at Grand Mogul Stope Complex
Soil	UASO019 – UASO021	Waste rock from Queen Anne Mine	Characterize source at Queen Anne Mine
Soil	UASO022- UASO024	Waste rock from Grand Mogul Mine	Characterize source at Grand Mogul Mine
Soil	UASO025 – UASO027	Opportunity Samples: Waste rock from Adelphin Mine	Characterize source at Adelphin Mine
Soil	UASO028 – UASO030	Opportunity Samples: Waste rock from Columbia Mine	Characterize source at Columbia Mine
Soil	UASO031 – UASO033	Opportunity Samples: Waste rock from area surrounding Gladstone/ American Tunnel Discharge	Characterize source at area surrounding American Tunnel discharge
Soil	UASO034- UASO036	Duplicate sample and MS/MSD Sample: location to be chosen on site	MS/MSD is collected to test the precision of laboratory analytical methods. Duplicate is collected to document the precision of sample collection procedures and laboratory analysis.

Sample designation - e.g., UASW001:
UA = project name
SW = matrix
001 = sample number)

TABLE 2
Non-Sampling Data Collection Rationale

Data Element	Data Collection Strategy and Rationale
Sensitive Environments	Locate, estimate, and photograph any wetlands observed that are not indicated on National Wetlands Inventory, meeting the 40 CFR 230.3 definition along Cement Creek
Soil Exposure Pathway	Document residences in the vicinity of mine waste sites and observe for indicators or evidence of terrestrial sensitive environments or threatened and endangered species.
Surface Water Pathway	Locate and identify seeps or contributing gulches along Cement Creek.

TABLE 3
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis			Quality Control Samples	
		Temp.	pH	Cond.	Dissolved Metals	Total Metals	PCBs	Dup.	MS/ MSD
UASW004	Surface Water	X	X	X	X				
UASW005	Surface Water	X	X	X	X				
UASW006	Surface Water	X	X	X	X				
UASW007	Surface Water	X	X	X	X				
UASW008	Surface Water	X	X	X	X				
UASW009	Surface Water	X	X	X	X				
UASW010	Surface Water	X	X	X	X				
UASW011	Surface Water	X	X	X	X				
UASW012	Surface Water	X	X	X	X				
UASW013	Surface Water	X	X	X	X				
UASW014	Surface Water	X	X	X	X				
UASW015	Surface Water	X	X	X	X				
UASW016	Surface Water	X	X	X	X				
UASW017	Surface Water	X	X	X	X				
UASW018	Surface Water	X	X	X	X				
UASW019	Surface Water	X	X	X	X				
UASW020	Surface Water	X	X	X	X				
UASW021	Surface Water	X	X	X	X				
UASW022	Surface Water	X	X	X	X				
UASW023	Surface Water	X	X	X	X				
UASW024	Surface Water	X	X	X	X				
UASW025	Surface Water	X	X	X	X				
UASW026	Surface Water	X	X	X	X				
UASW027	Surface Water	X	X	X	X				
UASW028	Surface Water	X	X	X	X				
UASW029	Surface Water	X	X	X	X				
UASW030	Surface Water	X	X	X	X				
UASW031	Surface Water	X	X	X	X				

TABLE 3, cont.
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis			Quality Control Samples	
		Temp.	pH	Cond.	Dissolved Metals	Total Metals	PCBs	Dup.	MS/ MSD
UASW032	Surface Water	X	X	X	X				
UASW033	Surface Water	X	X	X	X				
UASW034	Surface Water	X	X	X	X				
UASW035	Surface Water	X	X	X	X				
UASW036	Surface Water	X	X	X	X				
UASW037	Surface Water	X	X	X	X				
UASW038	Surface Water	X	X	X	X				
UASW039	Surface Water	X	X	X	X				
UASW040	Surface Water	X	X	X	X				
UASW041	Surface Water	X	X	X	X				
UASW042	Surface Water	X	X	X	X				
UASW043	Surface Water	X	X	X	X				
UASW044	Surface Water	X	X	X	X				
UASW045	Surface Water	X	X	X	X				
UASW046	Surface Water	X	X	X	X				
UASW047	Surface Water	X	X	X	X				
UASW048	Surface Water	X	X	X	X				
UASW049	Surface Water	X	X	X	X				
UASW050	Surface Water	X	X	X	X				
UASW051	Surface Water	X	X	X	X				
UASW052	Surface Water	X	X	X	X				
UASW053	Surface Water	X	X	X	X				
UASW054	Surface Water	X	X	X	X				
UASW055	Surface Water	X	X	X	X				
UASW056	Surface Water	X	X	X	X				
UASW057	Surface Water	X	X	X	X				
UASW058	Surface Water	X	X	X	X				
UASW059	Surface Water	X	X	X	X				
UASW060	Surface Water	X	X	X	X				

TABLE 3, cont.
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis			Quality Control Samples	
		Temp.	pH	Cond.	Dissolved Metals	Total Metals	PCBs	Dup.	MS/ MSD
UASW061	Surface Water	X	X	X	X				
UAAD001	Surface Water	X	X	X	X	X			
UAAD002	Surface Water	X	X	X	X	X			
UAAD003	Surface Water	X	X	X	X	X			
UAAD004	Surface Water	X	X	X	X	X			
UAAD005	Surface Water	X	X	X	X	X			
UAAD006	Surface Water	X	X	X	X	X			
UAAD007	Surface Water	X	X	X	X	X			
UAAD008	Surface Water	X	X	X	X	X			X
UASW097	Surface Water	X	X	X	X	X		X	X
UASW098	Surface Water	X	X	X	X	X		X	X
UASW099	Surface Water	X	X	X	X	X		X	X
UASE004	Sediment					X	X		
UASE005	Sediment					X	X		
UASE006	Sediment					X	X		
UASE007	Sediment					X	X		
UASE008	Sediment					X	X		
UASE009	Sediment					X	X		
UASE010	Sediment					X	X		
UASE011	Sediment					X	X		
UASE012	Sediment					X	X		
UASE013	Sediment					X	X		
UASE014	Sediment					X	X		
UASE015	Sediment					X	X		
UASE016	Sediment					X	X		
UASE017	Sediment					X	X		
UASE018	Sediment					X	X		
UASE019	Sediment					X	X		
UASE020	Sediment					X	X		

TABLE 3, cont.
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis			Quality Control Samples	
		Temp.	pH	Cond.	Dissolved Metals	Total Metals	PCBs	Dup.	MS/ MSD
UASE021	Sediment					X	X		
UASE022	Sediment					X	X		
UASE023	Sediment					X	X		
UASE024	Sediment					X	X		
UASE025	Sediment					X	X		
UASE026	Sediment					X	X		
UASE027	Sediment					X	X		
UASE028	Sediment					X	X		
UASE029	Sediment					X	X		
UASE030	Sediment					X	X		
UASE031	Sediment					X	X		
UASE032	Sediment					X	X		
UASE033	Sediment					X	X		
UASE034	Sediment					X	X		
UASE035	Sediment					X	X		
UASE036	Sediment					X	X		
UASE037	Sediment					X	X		
UASE038	Sediment					X	X		
UASE039	Sediment					X	X		
UASE040	Sediment					X	X		
UASE041	Sediment					X	X		
UASE042	Sediment					X	X		
UASE043	Sediment					X	X		
UASE044	Sediment					X	X		
UASE045	Sediment					X	X		
UASE046	Sediment					X	X		
UASE047	Sediment					X	X		
UASE048	Sediment					X	X		
UASE049	Sediment					X	X		

TABLE 3, cont.
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis			Quality Control Samples	
		Temp.	pH	Cond.	Dissolved Metals	Total Metals	PCBs	Dup.	MS/ MSD
UASE050	Sediment					X	X		
UASE051	Sediment					X	X		
UASE052	Sediment					X	X		
UASE053	Sediment					X	X		
UASE054	Sediment					X	X		
UASE055	Sediment					X	X		
UASE056	Sediment					X	X		
UASE057	Sediment					X	X		
UASE058	Sediment					X	X		
UASE059	Sediment					X	X		
UASE060	Sediment					X	X		
UASE061	Sediment					X	X		
UASE097	Sediment					X	X	X	X
UASE098	Sediment					X	X	X	X
UASE099	Sediment					X	X	X	X
UASO001	Soil (source)					X	X		
UASO002	Soil (source)					X	X		
UASO003	Soil (source)					X	X		
UASO004	Soil (source)					X	X		
UASO005	Soil (source)					X	X		
UASO006	Soil (source)					X	X		
UASO007	Soil (source)					X	X		
UASO008	Soil (source)					X	X		
UASO009	Soil (source)					X	X		
UASO010	Soil (source)					X	X		
UASO011	Soil (source)					X	X		
UASO012	Soil (source)					X	X		
UASO013	Soil (source)					X	X		
UASO014	Soil (source)					X	X		

TABLE 3, cont.
Sample Plan Checklist

Sample Location	Sample Type	Field Parameters			Analysis			Quality Control Samples	
		Temp.	pH	Cond.	Dissolved Metals	Total Metals	PCBs	Dup.	MS/ MSD
UASO015	Soil (source)					X	X		
UASO016	Soil (source)					X	X		
UASO017	Soil (source)					X	X		
UASO018	Soil (source)					X	X		
UASO019	Soil (source)					X	X		
UASO020	Soil (source)					X	X		
UASO021	Soil (source)					X	X		
UASO022	Soil (source)					X	X		
UASO023	Soil (source)					X	X		
UASO024	Soil (source)					X	X		
UASO025	Soil (source)					X	X		
UASO026	Soil (source)					X	X		
UASO027	Soil (source)					X	X		
UASO028	Soil (source)					X	X		
UASO029	Soil (source)					X	X		
UASO030	Soil (source)					X	X		
UASO031	Soil (source)					X	X		
UASO032	Soil (source)					X	X		
UASO033	Soil (source)					X	X		
UASO034	Soil (source)					X	X	X	X
UASO035	Soil (source)					X	X	X	X
UASO036	Soil (source)					X	X	X	X

TABLE 4
Sample Container Types, Volumes, and Sample Preservation

Sample Matrix	Analysis	Analytical Method Number	Units	Container Number and Type[1]	Required Volume	Preservation[2]	Technical Holding Time[3]
Surface Water	Dissolved Metals	CLP-SOW ILM04.1	µg/L	1 – HDPE	1 liter	Cool to 4° C; Nitric Acid to pH <2	6 months (Hg - 28 days)
Surface Water	Total Metals	CLP-SOW ILM04.1	µg/L	1 – HDPE	1 liter	Cool to 4° C; Nitric Acid to pH <2	6 months (Hg - 28 days)
Sediment	Total Metals	CLP-SOW ILM04.1	µg/kg	1 – HDPE	8 ounces	Cool to 4° C	6 months (Hg - 28 days)
Sediment	PCBs	CLP-SOW OLM04.2 or OLC02.1	µg/kg	1 – glass	8 ounces	Cool to 4° C	14 days
Soil	Total Metals	CLP-SOW ILM04.1	µg/kg	1 – HDPE	8 ounces	Cool to 4° C	6 months (Hg - 28 days)

1 Recommended container types: HDPE = high density polyethylene bottle and cap.

2 Preserve the samples as soon as they are collected. Add required preservatives to filtered samples following filtration. Completely fill containers used for volatile organic samples, permitting no head space.

3 Technical holding time is the time interval from sample collection until sample analysis (or until sample extraction for semivolatile compounds). Technical holding times are determined by method and by matrix.

TABLE 5
EPA Region 8 and ESAT Inorganic Reporting Limits for Water Samples

	ICP-OE EPA Method 200.7	ICP-MS EPA Method 200.8	Historic ARSG RLs
Element	ug/L	ug/L	ug/L
Aluminum	100	NA	20
Antimony	NA	1	2
Arsenic	NA	4	1
Barium	4	0.3	0.5
Beryllium	1	NA	0.2
Boron	100	NA	NA
Cadmium	1	0.2	0.2
Calcium	100*	NA	100*
Chromium	2	NA	5
Cobalt	2	NA	2
Copper	10	3	0.8
Iron	100	NA	5
Lead	10	1	0.5
Magnesium	50*	NA	50*
Manganese	2	NA	0.5
Molybdenum	4	NA	0.5
Nickel	2	1	0.3
Potassium	1000*	NA	1000*
Selenium	NA	1	1
Silica	400	NA	200
Silver	8	0.5	0.3
Sodium	500*	NA	500*
Strontium	2	NA	3
Thallium	NA	0.3	20
Titanum	5	NA	5
Vanadium	10	NA	10
Zinc	40	5	4
Hardness (mg/L)*	Calculated from dissolved Ca and Mg		0.2 mg/l

NA - Not applicable
* From dissolved fraction

TABLE 6
Field Parameters to Be Collected at Surface Water Sample Locations

Parameter, units	Instrument	Reporting Limit	Adjacent Measurement Accuracy Goals	Holding Time	EPA Method Number	Container type
Temperature, °C	Multimeter	0.1 °C	0.5 °C	Field analysis	EPA 170.1	In situ or instrument cup
Specific Conductance, µSiemens/cm	Multimeter	1 µS/cm	15%	Field analysis	EPA 120.1	In situ or instrument cup
pH, standard units (s.u.)	Multimeter	0.01 s.u.	0.5 s.u.	Field analysis	EPA 150.1	In situ or instrument cup